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9. (Twice Amended) A process of preparing a medium to high voltage power cable according to claim 1, in which a conductor is surrounded in order by an inner semi-conducting layer, an insulating layer comprising a crosslinkable polymer with hydrolyzable silane group, and an outer semi-conducting layer to form a cable, characterized in that the cable is crosslinked in the presence of steam at a superatmospheric pressure.

10. (Amended) A process according to claim 9, wherein the crosslinking is carried out in a vulcanizing tube.

#### In the specification

Please replace the paragraph beginning at page 1, line 19 and going to page 1, line 23 with the following paragraph.

--Crosslinked ethylene polymers are used for the insulating layer. LDPE (low-density polyethylene, i.e. polyethylene prepared by radical polymeri[s]zation at a high pressure) is today the predominant cable insulating material.--

Please replace the paragraph beginning at page 1, line 24 and ending at page 2, line 3 with the following paragraph.

--In addition to the polyethylene base resin insulating compositions usually contain additives to improve the physical properties of the insulating layer of the electric cable and to increase its resistance to the influence of different conditions. The total amount of the additives is generally about 0.3-5% by weight, preferably about 1-4% by weight. The additives include stabilizing additives such as antioxidants to counteract decomposition due to oxidation, radiation, etc.; lubricating additives, such as stearic acid; additives for water-tree resistance, such as polyethylene glycol, silicones etc.; and crosslinking additives such as peroxides to aid in the crosslinking of the ethylene polymer of the insulating composition.--

Please replace the paragraph beginning at page 2, line 13 and ending at page 2, line 29 with the following paragraph.

-- The crosslinking is performed after the extrusion of the insulating layer in a long, e.g. about 100-200 m, multi-zone vulcanization tube where crosslinking should take place as rapidly and completely as possible. The vulcanizing tube, which preferably is of a continuous vulcanizing (CV) type, has at least one heating zone and at least one cooling zone and the vulcanizing is initiated by the heat emitted in one or more of the heating zones of the vulcanizing tube. Generally, the temperature in the heating zone(s) of the vulcani[s]ing tube is up to about 400°C. A nitrogen-gas pressure is also applied in the tube, and contributes to prevent oxidation processes by keeping away oxygen of the air and to reduce the formation of microcavities, so-called voids, in the polymer layers by reducing the expansion of the gases resulting from the decomposition of the radical-forming crosslinking agent.--

Please replace the paragraph beginning at page 3, line 7 and ending at page 3, line 17 with the following paragraph.

--It is also known to crosslink ethylene polymers by way of crosslinkable groups such as hydrolyzable silane groups in the polymer. The crosslinking of polymers with hydrolyzable silane groups is carried out by so-called moisture curing. In a first step, the silane groups are hydrolyzed under the influence of water or steam, resulting in the splitting-off of alcohol and the formation of silanol groups. In a second step, the silanol groups are crosslinked by a condensation reaction splitting off water. In both steps, a so-called silanol condensation catalyst is used as a catalyst.--

Please replace the paragraph beginning at page 3 line 18 and ending at page 3, line 22 with the following paragraph.

-- Silanol condensation catalysts include carboxylates of metals, such as tin, zinc, iron, lead and cobalt; organic bases; inorganic acids; and organic acids. In practice dibutyl tin dilaurate (DBTDL) is generally used as the silanol condensation catalyst.--

Please replace the paragraph beginning at page 3, line 23 and ending at page 4, line 18 with the following paragraph.

--However, silanol condensation catalysts such as DBTDL give poor performance at normal ambient temperatures and relative humidities. To function satisfactorily they require a sauna or water bath at an elevated temperature in the order of 70-100°C. Although the crosslinking is speeded up by increasing the temperature, it may take 6-24 hours to carry out the crosslinking for a thin LV cable and from 1 to 7 days for an MV cable, depending on thickness and curing temperature. Moreover, DBTDL is a tin-organic catalyst which is negative from an environmental point of view. A particular problem is encountered in connection with crosslinking of insulating layers of medium voltage and high voltage power cables because of the difficulty for the water to reach and completely crosslink the layer. This is due to the fact that the insulating layer is covered by the outer semi-conductor layer and that the insulating layer has a substantial thickness. Generally, the insulating layer of a medium voltage power cable is at least about 2 mm thick, typically at least 2.3 mm thick and the thickness increases with the voltage of the cable. Thus, the insulating layer of a 10 kV cable typically has a thickness of about 3.6 mm and in a 20 kV cable this layer typically has a thickness of about 5.5 mm. The more layers that cover the insulating layer and the greater its thickness the more difficult it will be and the longer it will take for the water to reach and crosslink the insulating layer. Indeed, polymers containing hydrolyzable silane groups have hitherto not been considered feasible as insulating layers for power cables of voltages over 20 kV, i.e. having an insulating layer thickness of more than about 5 mm, due to the excessive time needed for crosslinking.--

Please replace the paragraph beginning at page 4, line 19 and ending at page 4, line 24 with the following.

-- From the above it is evident that the crosslinking of electric power cables using hydrolyzable silane group containing polymers for the insulating layer is also associated with several disadvantages and that it would mean an important technical progress if crosslinking could be achieved without these disadvantages.--

Please replace the paragraph beginning at page 5, line 1 and ending at page 5, line 7 with the following paragraph.

--According to one aspect of the present invention it has been found that it is possible to use a crosslinkable hydrolyzable silane group containing polymer as a base resin for the insulating layer of a medium to high voltage power cable if the prior art silanol condensation catalyst, such as DBTDL is replaced by a particular sulphonic acid catalyst.--

Please replace the paragraph beginning at page 5, line 15 and ending at page 5, line 21 with the following paragraph.

--According to still another aspect of the present invention it has been found that the medium to high voltage power cable may be prepared by carrying out the crosslinking of the cable at superatmospheric pressure in the presence of steam, preferably in a vulcanizing tube usually used for the crosslinking of peroxide crosslinkable power cables.--

Please replace the paragraph beginning at page 5, line 22 and ending at page 5, line 37 with the following paragraph.

-- The present invention thus provides a composition for an insulating layer of a medium to high voltage power cable, characterized in that the composition comprises a crosslinkable polymer with hydrolyzable silane groups, and a silanol condensation catalyst of formula I



(I)

or a precursor thereof, Ar being a benzene ring substituted with at least one hydrocarbyl radical such that the total number of carbon atoms of the hydrocarbyl radical(s) is 8-20, or a naphthalene ring substituted with at least one hydrocarbyl radical such that the total number of carbon atoms of the hydrocarbyl radical(s) is 4-18, and the catalyst of formula I containing 14-28 carbon atoms in total.--

Please replace the paragraph beginning at page 6, line 1 and ending at page 6, line 7 with the following paragraph.

--The present invention further provides a medium to high voltage power cable comprising a conductor (100) surrounded in order by an inner semi-conducting layer (105), an insulating layer (110), and an outer semi-conducting layer (115), characterized in that the insulating layer has a thickness of more than 2 mm and comprises the crosslinked product of a composition as defined above.--

Please replace the paragraph beginning at page 6, line 8 and ending at page 6, line 12 with the following paragraph.

--Still further, the present invention provides a process of preparing a medium to high voltage power cable as defined above, characterized in that the cable is crosslinked in the presence of steam at a superatmospheric pressure.--

Please replace the paragraph beginning at page 6, line 13 and ending at page 6, line 15 with the following paragraph.

--Further characterizing features and advantages of the present invention will appear from the following description and the appended claims.--

Please insert the following paragraph before page 6, line 16.

--Figure 1 depicts a power cable in accordance with the invention.

Please replace the paragraph beginning at page 6, line 17 and ending at page 6, line 28 with the following paragraph.

--A silanol condensation catalyst of the above defined type is disclosed in WO 95/17463 for the crosslinking of polymers with hydrolyzable silane groups in general. However, it does not disclose the specific use of such a catalyst for the crosslinking of insulating layers of medium to high voltage power cables or that it may surprisingly overcome the particular problems associated with the crosslinking of such insulating layers. Further, as will be explained and illustrated in more detail below, this catalyst quite surprisingly gives improved water treeing characteristics to the insulating layer of a medium to high voltage power cable.--

Please replace the paragraph beginning at page 7, line 20 and ending at page 7, line 29 with the following paragraph.

--As indicated above, the present invention provides a composition that preferably is hydrophilic and/or amorphous and that comprises a polymer with hydrolyzable silane groups and a silanol condensation catalyst having the formula I. In particular, the composition is contemplated for use as an insulating layer of a medium to high voltage power cable. Other applications for the composition may, however, also be contemplated such as pipes, particularly water pipes and gas pipes, and products made by injection or rotational moulding.--

Please replace the paragraph beginning at page 7, line 36 and ending at page 8, line 16 with the following paragraph.

--As mentioned above, the process according to the present invention for preparing a medium to high voltage power cable comprising the composition of the invention as the insulating layer of the cable, is characterized in that the crosslinking is carried out in the presence of steam at a superatmospheric pressure. This is in contrast to conventional crosslinking of hydrolyzable silane group containing polymers which is carried out at atmospheric pressure in the presence of moisture, i.e. steam or water. Preferably the crosslinking of the present invention is carried out in the presence of saturated steam at the pressure in question. The pressure preferably lies in the range from about 0.2 MPa to about 2.5 MPa, more preferably from about 0.2 MPa to about 1.5 MPa, and most preferably from about 0.8 MPa to about 1.2 MPa. A pressure of 0.8 MPa corresponds to saturated steam of a temperature of about 170°C and 1.2 MPa corresponds to saturated steam of a temperature of about 190°C.--

Please replace the paragraph beginning at page 8, line 17 and ending at page 8, line 23 with the following paragraph.

--It is preferred, especially where the hydrophilicity is low and the crystallinity is relatively high, like when an ethylene/vinyl trimethoxysilane copolymer is used as the base resin, that the crosslinking is that the crosslinking is carried out in a vulcanizing

tube, such as a CV tube as described above normally used for the crosslinking of peroxide crosslinkable power cables.--

Please replace the paragraph beginning at page 8, line 24 and ending at page 8, line 27 with the following paragraph.

--In the following the crosslinkable hydrolyzable silane group containing polymer used as the base resin of the insulating layer composition according to the present invention will be described.--

Please replace the paragraph beginning at page 8, line 28 and ending at page 8, line 35 with the following paragraph.

--The crosslinkable base resin generally is an olefin copolymer or graft polymer which contains hydrolyzable silane groups and which is crosslinked under the influence of water and at least one silanol condensation catalyst. Specifically, the crosslinkable polymer is an ethylene copolymer or homopolymer containing crosslinkable silane groups introduced either by copolymerization or graft polymerization.--

Please replace the paragraph beginning at page 8, line 36 and ending at page 9, line 12 with the following paragraph.

--Preferably, the silane-containing polymer has been obtained by copolymerization of an olefin, suitably ethylene, and an unsaturated silane compound represented by the formula



wherein

R is an ethylenically unsaturated hydrocarbyl, hydrocarbyloxy or (meth)acryloxy hydrocarbyl group,

R' is an aliphatic saturated hydrocarbyl group,

Y which may be same or different, is a hydrolyzable organic group, and

n is 0, 1 or 2.--

Please replace the paragraph beginning at page 9, line 21 and ending at page 9, line 27 with the following paragraph.

--A preferred unsaturated silane compound is represented by formula



wherein A is a hydrocarbyl group having 1-8 carbon atoms, preferably 1-4 carbon atoms.--

Please replace the paragraph beginning at page 9, line 32 and ending at page 9, line 35 with the following paragraph.

--The copolymerization of the olefin (ethylene) and the unsaturated silane compound may be carried out under any suitable conditions resulting in the copolymerization of the two monomers.--

Please replace the paragraph beginning at page 10, line 3 and ending at page 10, line 37 with the following paragraph.

--Moreover, the copolymerization (or grafting) may be implemented in the presence of one or more other comonomers which can be copolymerized (or grafted) with the two monomers. The copolymerization (or grafting) with other comonomers besides the unsaturated silane comonomer is applied in particular when it is desired to make the crosslinkable polymer composition hydrophilic and/or amorphous. In that case the comonomer (or termonomer) should include at least one hydrophilic group, such as an acyl group, an hydroxyl group or an ester group. As non-limiting examples of hydrophilic comonomers may be mentioned the following: (a) vinyl carboxylate esters, such as vinyl acetate and vinyl pivalate, (b) (meth)acrylates, such as methyl(meth)acrylate, ethyl(meth)acrylate and butyl(meth)acrylate, (c) olefinically unsaturated carboxylic acids, such as (meth)acrylic acid, maleic acid and fumaric acid, (d) (meth)acrylic acid derivatives, such as (meth)acrylonitrile and (meth)acrylic amide, and (e) vinyl ethers, such as vinyl methyl ether and vinyl phenyl ether. Amongst these



comonomers, vinyl esters of monocarboxylic acids having 1-4 carbon atoms, such as vinyl acetate, and (meth)acrylates of alcohols having 1-4 carbon atoms, such as methyl(meth)acrylate, are preferred. Especially preferred comonomers are butyl acrylate, ethyl acrylate and methyl acrylate. Two or more such olefinically unsaturated compounds may be used in combination. The term '(meth)acrylic acid' is intended to embrace both acrylic acid and methacrylic acid. The hydrophilic comonomer contents of the hydrophilic copolymer may amount to as much 40% by weight of the copolymer but more normally amounts to between 3 and 20% by weight. The amount will to a great deal depend on the flexibility wanted in the resin, since the higher the comonomer content the more flexible and rubberlike will be the cable insulation.--

Please replace the paragraph beginning at page 11, line 6 and ending at page 11, line 16 with the following paragraph.

--Because of the increased hydrophilicity of the composition according to the above aspect of the present invention care should be taken to keep the composition out of contact with water before shaping the composition into a cable insulating layer in order to avoid undesired premature crosslinking or scorching of the composition. Alternatively or in addition a so-called scorch retarder may be added to the composition. Such scorch retarders are known per se and comprise compounds that react chemically with water such as e.g. hydrolyzable silane compounds.--

Please replace the paragraph beginning at page 11, line 17 and ending at page 11, line 32 with the following paragraph.

--The silanol condensation catalyst defined above and used at the present invention is distinguished by being a benzene or naphthalene sulphonic acid that is sufficiently lipophilic to be compatible with the polymer composition to be crosslinked. To achieve such lipophilicity, the hydrocarbon group of the alkylaryl sulphonic acid must have a certain size and must, e.g. in the case where the acid is a benzene sulphonic acid, have an alkyl substituent containing at least 8 carbon atoms, and in the case where the acid is a naphthalene sulphonic acid the alkyl substituent must contain at least 4 carbon atoms. If the alkyl group does not have such a size that the lipophilicity requirement is met, the

catalyst is not compatible with the polymer composition but will be released therefrom upon crosslinking in aqueous solution, thus impairing crosslinking efficiency.--

Please replace the paragraph beginning at page 12, line 4 and ending at page 12, line 13 with the following paragraph.

--The silanol condensation catalyst used at the present invention may also be a precursor of a compound of formula I, i.e. a compound that is converted by hydrolysis to a compound of formula I. Such a precursor is the acid anhydride of the sulphonic acid compound of formula I. Another instance is a sulphonic acid of formula I that has been provided with a hydrolyzable protective group, e.g. an acetyl group, which can be removed by hydrolysis to give the sulphonic acid of formula I.--

Please replace the paragraph beginning at page 13, line 3 and ending at page 13, line 17 with the following paragraph.

--As indicated above, the present invention aims at alleviating or eliminating the problems of prior art insulating layer compositions for medium to high voltage power cables where mainly peroxide crosslinking has been used earlier. While theoretically an alternative to peroxide crosslinking, crosslinking of hydrolyzable silane group containing polymers with conventional silanol condensation catalysts has found little or no practical use. The reason for this is the disadvantages involved such as very long crosslinking times that reduce the productivity. Moreover, it has not been considered economically feasible to crosslink silane containing insulating layers in power cables of more than 20 kV due to the thickness of the insulating layer (5 mm or more) and the difficulty of moisture curing such thick layers.--

Please replace the paragraph beginning at page 13, line 29 and ending at page 13, line 35 with the following paragraph.

--Further, due to the absence of peroxide crosslinking agent no environmental pollutants from peroxide decomposition are generated. The particular silanol condensation catalyst used according to the present invention is no environmental

pollutant; it is not dissolved from the polymer composition in water baths; and it does not discolor the polymer composition.--

Please replace the paragraph beginning at page 14, line 10 and ending at page 14, line 18 with the following paragraph.

--It is possible to use existing vulcanizing tubes for the crosslinking of the insulating composition. The only modification that may be required is to provide the vulcanizing tube with an inlet for steam. The possibility of using existing vulcanizing tubes is an important advantage of the invention and makes it possible for a cable manufacturer to change the production from peroxide crosslinked cables to moisture cured silane group containing cables with no or only a minor investment.--

Please replace the paragraph beginning at page 14, line 19 and ending at page 14, line 28 with the following paragraph.

--The crosslinking temperature is lower at the present invention than at peroxide crosslinking. Thus, while the temperature in a vulcanizing tube is about 400°C at peroxide crosslinking, as mentioned above, the temperature in a vulcanizing tube used for crosslinking of the silane group containing polymer composition of the present invention is preferably only about 170-190°C. This lower crosslinking temperature means that less energy is consumed for the crosslinking at the present invention.--

Please replace the paragraph beginning at page 14, line 32 and ending at page 14, line 35 with the following paragraph.

-- Compared to crosslinking using conventional prior art silanol condensation catalysts, such as DBTDL as well as compared to crosslinking with peroxides, the present invention provides a much higher crosslinking speed.--

Please replace the paragraph beginning at page 14, line 36 and ending at page 15, line 2 with the following paragraph.

--Further, it is possible to carry out the crosslinking at a much lower temperature, such as room temperature, than with conventional silanol condensation catalysts (DBTDL).--

Please replace the paragraph beginning at page 15, line 3 and ending at page 15, line 7 with the following paragraph.

--A particular advantage is that it is possible to use hydrolyzable silane containing polymers for the insulating layer of medium to high voltage power cables of more than 20 kV, i.e. power cables with an insulating layer that is more than 5 mm thick.--

Please replace the paragraph beginning at page 15, line 26 and ending at page 15, line 37 with the following paragraph.

--A composition according to the present invention was made into a cable insulation and its dielectric strength evaluated according to the so-called Model Cable Test developed by Alcatel AG & Co, Hannover, Germany, and described in an article by Land H.G., Schädlich Hans, "Model Cable Test for Evaluating the Aging behavior under Water Influence of Compounds for Medium Voltage Cables", Conference Proceedings of Jicable 91, 24-28 June 1991, Versailles, France. As a value of the dielectric strength is stated 63% of  $E_{max}$  from Weibull diagram in kV/mm. The dielectric strength was measured after aging for 1000 hrs at 9 kV/mm in 85°C/70°C water.--

Please replace the paragraph beginning at page 17, line 11 and ending at page 17, line 15 with the following paragraph.

--In order to show the improved crosslinking rate of the insulating composition of the present invention compared to an insulating composition using a conventional silanol condensation catalyst (DBTDL) the following test was made.--

Please replace the paragraph beginning at page 17, line 27 and ending at page 18, line 3 with the following paragraph.

--The insulating layer of the reference cable (referred to as Reference cable 3) consisted of the same base resin, but compounded with 5% by weight of a master batch

consisting of 57.5% by weight of ethylene butyl acrylate copolymer (27% by weight of butyl acrylate), 34% by weight of LDPE, 4.5% by weight of stabilizers, 1% by weight of zinc stearate, and 3% by weight of DBTDL. The master batch had an  $MFR_2 = 5 \text{ g/10 min.}$ --

Please replace the paragraph beginning at page 18, line 20 and ending at page 18, line 24 with the following paragraph.

--The crosslinking of a medium to high voltage power cable with an insulating layer according to the present invention was tested and compared to the crosslinking of a similar cable, but with an insulating layer with a conventional DBTDL silanol condensation catalyst.--

Please replace the paragraph beginning at page 18, line 28 and ending at page 18, line 35 with the following paragraph.

--The reference cable (referred to as Reference Cable 4) had an insulating layer with the same base resin as that of Cable 4 compounded with 5% by weight of a master batch consisting of 57% by weight of ethylene butyl acrylate copolymer (27% by weight of butyl acrylate), 34% by weight of LDPE, 5.7% by weight of stabilizers, 1% by weight of zinc stearate, and 2% by weight of DBTDL. The master batch had an  $MFR_2 = 5 \text{ g/10 min.}$ --

Please replace the paragraph beginning at page 19, line 13 and ending at page 19, line 20 with the following paragraph.

--It is evident that crosslinking of medium to high voltage power cable insulating layers according to the present invention is very quick and effective compared to the crosslinking of a similar insulating layer with a conventional DBTDL catalyst, and that the medium to high voltage power cable insulating composition presents a feasible alternative to conventional peroxide crosslinked insulating layers of medium to high voltage power cables.--

Please replace the paragraph beginning at page 20, line 27 and ending at page 20, line 32 with the following paragraph.

-- In order to show the possibility of crosslinking a power cable according to the present invention with the use of vulcanizing tube and the improved crosslinking rate of the insulating composition of the present invention compared to a conventional silanol condensation catalyst (DBTDL) the following tests were made.--

Please replace the paragraph beginning at page 21, line 1 and ending at page 21, line 14 with the following paragraph.

--The composition of the insulating layer of the cables was varied. The first cable which was a cable according to the present invention (referred to as Cable 6a) had a composition corresponding to that of Cable 3 of Example 3 above (a silane group containing ethylene copolymer). The second cable which was also a cable according to the present invention (referred to as Cable 6b) had an insulating layer composition corresponding to that of Cable 5b of Example 5 above (a hydrophilic silane group containing ethylene/butyl acrylate terpolymer). The third cable which was not according to the present invention (referred to as Reference cable 6) had a composition corresponding to that of Reference cable 3 of Example 3 above (DBTDL as catalyst).--

Please replace the paragraph beginning at page 21, line 15 and ending at page 21, line 23 with the following paragraph.

--After extrusion of the cables they were crosslinked in a 20 m long laboratory vulcanizing tube with saturated steam at a pressure of 1.0 MPa gauge. The vulcanizing tube had four heating zones with the temperatures set at 179, 178, 178 and 135°C for Cable 6a; 177, 179, 181, and 183°C for Cable 6b; and 181, 179, 181 and 184°C for Reference cable 6. After the heating zones followed a cooling zone with cooling water. The line speed was 2 m/min for all three cables.--

Please replace the paragraph beginning at page 22, line 1 and ending at page 22, line 18 with the following paragraph.